



**Town Of Amherst
Traffic Study For
Lincoln Ave & Sunset Ave
Speed Cushions**



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INTRODUCTION

Residents of the Lincoln Avenue area have been concerned with the high volume and speed of vehicles traveling through this residential area for more than a decade. In 2006 many residents re-iterated their long standing concerns. This prompted the Department of Public Works to perform the initial traffic study. Baseline traffic data was gathered in the spring and fall of 2006 while classes were in session at the University of Massachusetts. All preliminary data was summarized in a report titled "*Town Of Amherst, Traffic Study For Lincoln Ave, Sunset Ave, Fearing St, McClellan St and North Prospect St*" dated November 2006 (available at <http://www.amherstma.gov/DocumentView.asp?DID=197>).

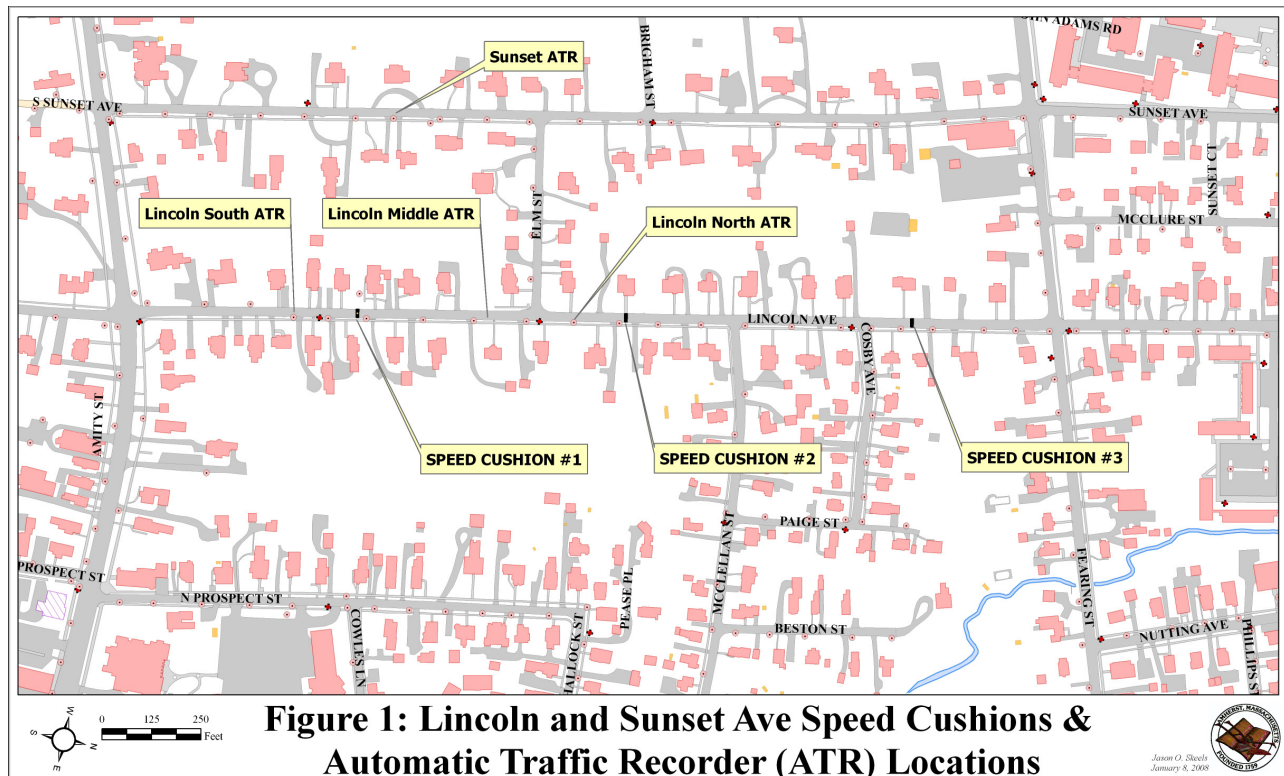
This report confirmed both the speed and volume problems and made possible recommendations to remedy both. At a public hearing held on December 12, 2006 results and recommendations contained in this report were presented to area residents and concerned parties. The feedback received with respect to the possible recommendations was controversial with no clear preferred solution.

In the summer of 2007 it was decided that a temporary experiment would be performed using speed cushions from Traffic Logix. In an effort to reduce speeds and calm traffic on a trial basis, the Department of Public Works installed the speed cushions on September 4th and 5th at three locations along Lincoln Ave. Automatic traffic recorders were placed at various locations in the area to monitor the results that the traffic cushions had on driver behavior. This report presents the results of this experiment and offers some alternative traffic calming recommendations.

STUDY METHODOLOGY

Speed Cushion Installation

Speed cushions from Traffic Logix are modular recycled rubber mats that are bolted to the pavement to create a gradual hump that is 7 feet long and 3 inches high at the center. On September 4th & 5th, 2007 speed cushions were installed at three locations along Lincoln Ave. The linear spacing was approximately 700 feet between cushions. Figure 1 shows the locations of the speed cushions along Lincoln Ave.



The initial horizontal spacing was designed to allow for a 3 foot wide bicycle lane on each side of the road and to allow the wide rear dual tires of emergency vehicles to straddle center cushion and avoid any vertical displacement that might damage the heavy vehicles or jeopardize passengers. Figure 2a shows the cross-section of the initial spacing. The initial spacing was left in place from September 5th to the 13th. After the first week it was clear that most vehicles were able to straddle the 4.5ft wide traffic cushions.

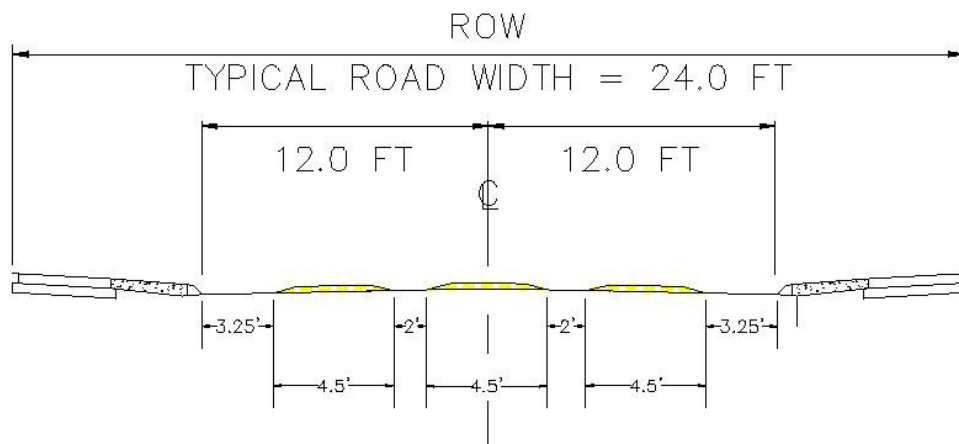


Figure 2a: Initial Speed Cushion Cross Section

On September 13th an additional 18 inch section was added to the two outside cushions. Figure 2b shows the modified cross-sectional profile. Speed cushions were removed on November 5th, 2007 because Traffic Logix speed cushions are not designed to endure winter snow plow activities.

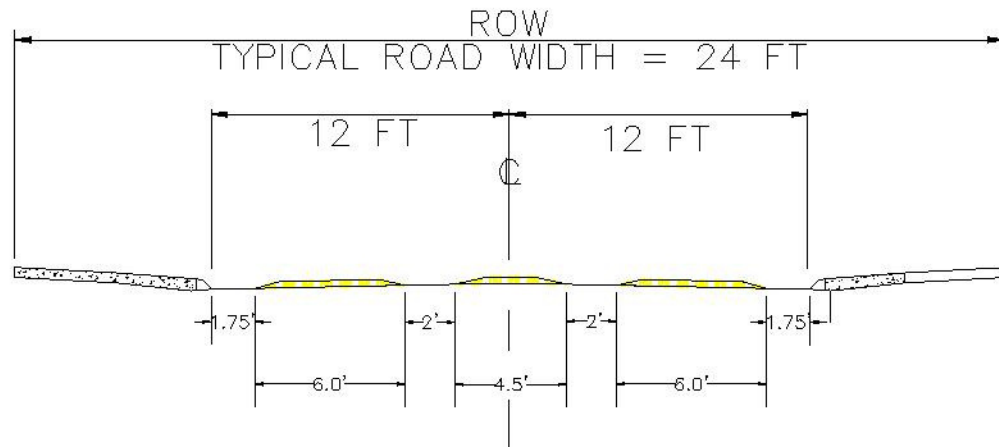


Figure 2b: Modified Speed Cushion Cross Section

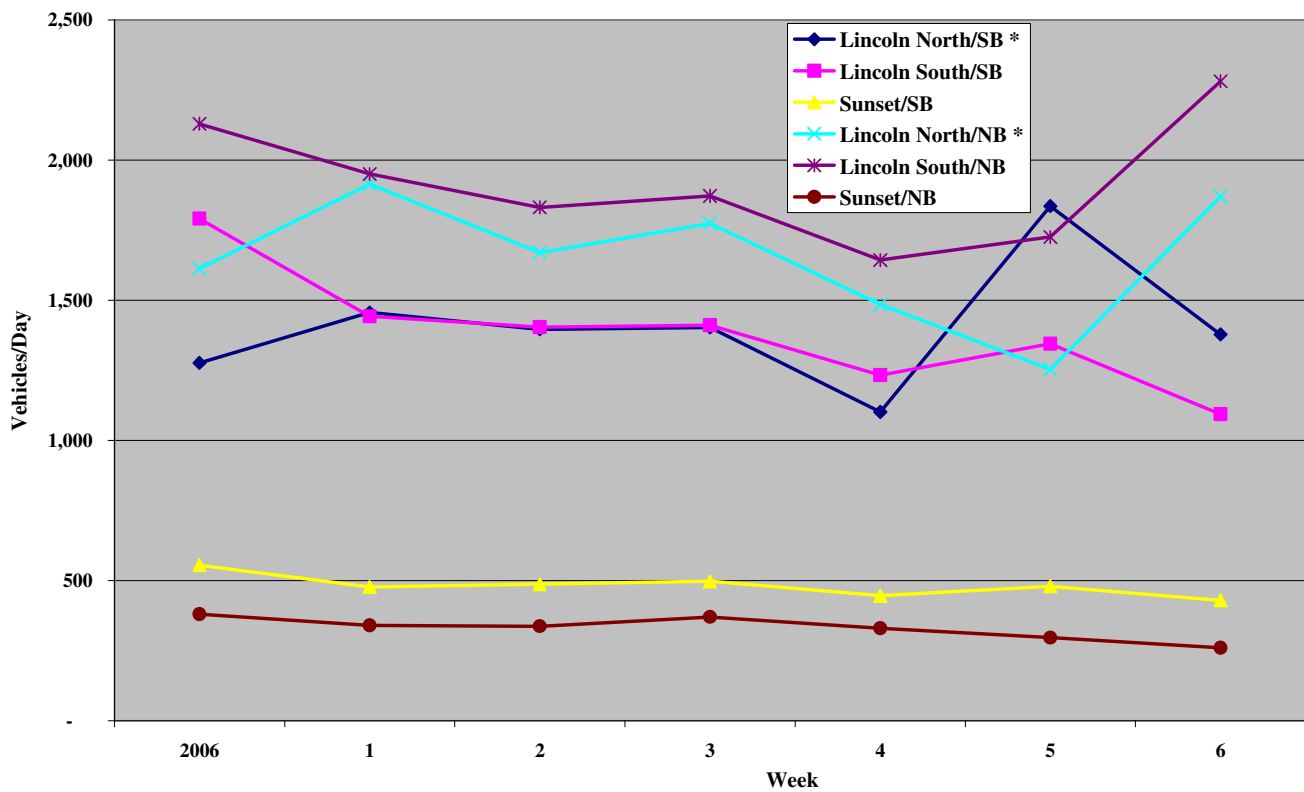
Data Collection

Baseline traffic data on Lincoln and Sunset Ave were collected in the spring and fall of 2006 by the Town of Amherst Engineering Division while classes were in session at the University of Massachusetts. Tube style automatic traffic recorders (ATR's) were placed at the same locations where they had been placed in 2006 on September 7th. Mike Knoddler, Assistant Professor in the Transportation Engineering Department at the University of Massachusetts installed the ATR's and performed all data collection services. Figure 1 (page 4) shows the ATR locations.

A total of six weeks of data were collected at two locations on Lincoln Ave and one on Sunset Ave. During week five of the study, a fourth ATR was placed at the midpoint between two of the traffic cushions on Lincoln in order to see if vehicles were traveling at higher speeds between speed cushions.

Data from the ATR's were downloaded, which included the date, time, speed and size of each vehicle passing over the data collector. Figure 3 shows the Average Daily Traffic (ADT) for the Lincoln and Sunset Ave traffic counts for both the northbound (NB) and southbound (SB) directions of travel. Figure 3 also includes the baseline data collected in 2006.

Figure 3: Average Daily Traffic Volumes



* Note: Lincoln North 2006 is the average of the spring and fall ADT for that location.

Figures 4 and 5 show the 85 percentile speeds for each location in the northbound and southbound directions, respectively.

Figure 4: Northbound 85th % Speeds

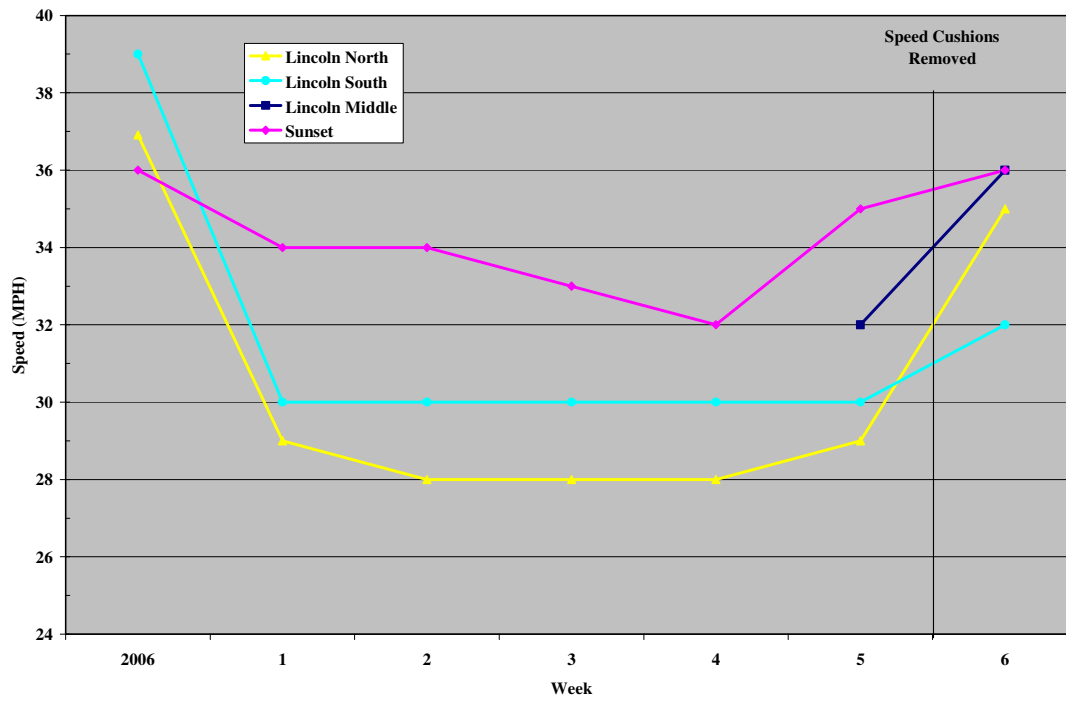


Figure 5: Southbound 85th % Speeds

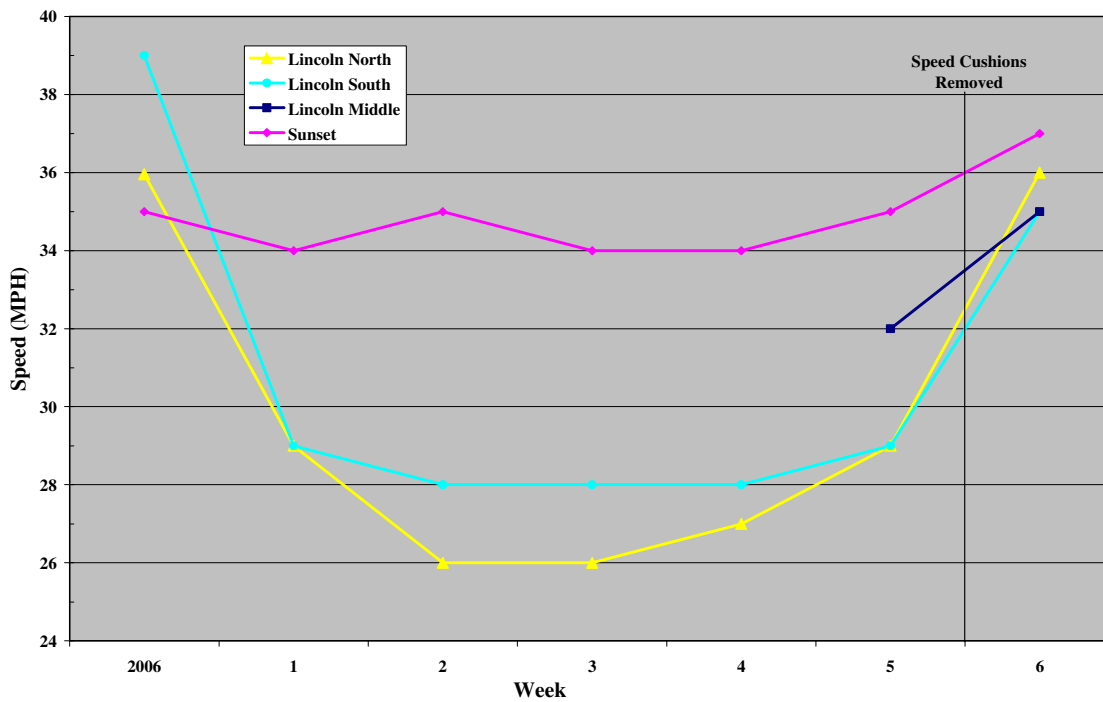
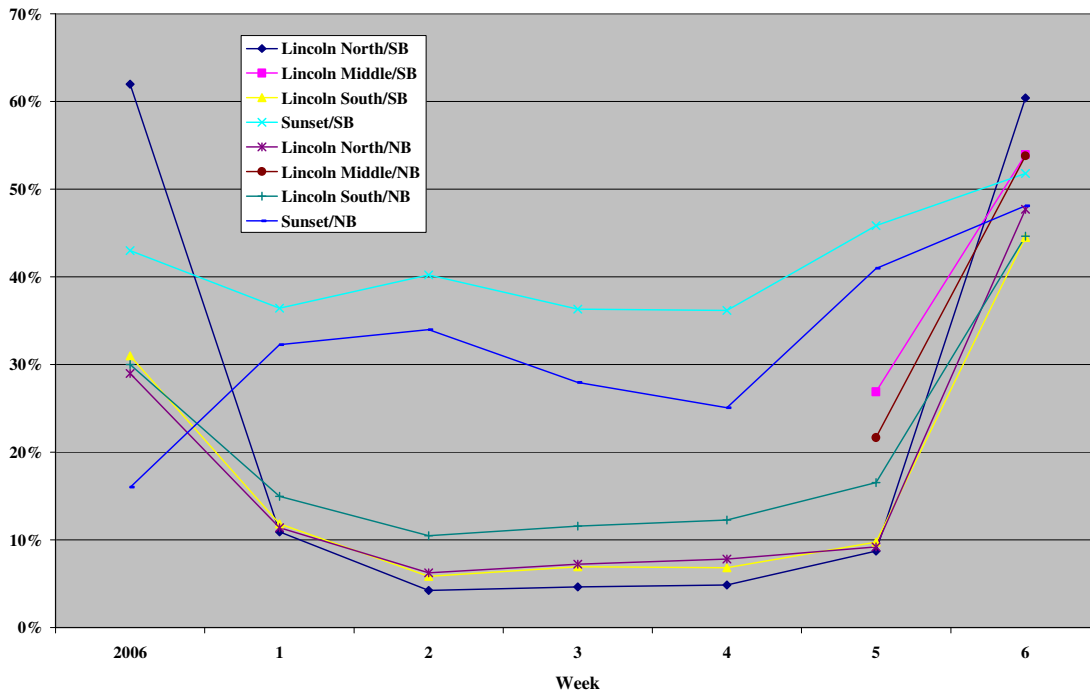


Figure 6 shows the percent of vehicles traveling greater the posted speed limit for each location.

Figure 6: % of Speeding Vehicles



All of the summarized data for this study can be seen in Table 1 of the appendix.

STUDY FINDINGS

Data Analysis

Volumes

Traffic flow often mimics the behavior of water, in that it usually takes the path of least resistance. In many cases when traffic calming is installed on a particular street, a large portion of that traffic volume tends to find an alternate route. This can often results in the displacement of the problem from one neighborhood to another.

During this study, one of the major concerns was that all of the traffic that used to flow down Lincoln Ave would just move to Sunset Ave. Figure 3 shows that traffic volumes on Sunset Ave remained at approximately 500 vehicles per day (vpd). Lincoln Ave traffic volumes show a slight decrease in volumes between week 1 and week 5 although there is not a significant decrease when compared to the

2006 baseline data. This is an indication that the speed cushions did discourage a small amount of cut-through traffic. There is a slight chance that the curiosity factor may have skewed the initial volumes due to the publicity and press surrounding the speed cushions.

Multiple increases in volume can be seen towards the end of the study which are difficult to explain.

There were multiple events at UMass on Nov1st and 2nd but no one individual event that might explain the over 500vpd increase. Including the weekend volumes in these averages might have also created arbitrary spikes in the data. Actually date ranges and total traffic volumes can be seen in Table 1 of the appendix.

Speeds

The 85th percentile speed is the speed at which 85% of the population feels comfortable driving for any given roadway; therefore, only 15% of drivers exceed the 85th percentile speeds. The 85th percentile speed is the most common measure that transportation engineers use to set posted speed limits. Accordingly it is the appropriate measure to determine if a traffic calming device effectively reduces speeds to the actual posted speed limit.

The initial speed cushion spacing in Figure 2a did reduce speeds as can be seen in Week 1 of Figures 4-6. The 4.5 ft width of the initial cushion installation is narrower than the wheel base of most vehicles thereby allowing almost any vehicle to straddle the speed cushions without altering their speed. Due to the relatively short time duration of this spacing it is inconclusive as to whether drivers would have learned to straddle the narrow cushions and returned to higher speeds.

The modified speed cushion spacing, installed the second week, shown in Figure 2b resulted in an even greater reduction of speeds as can be seen in Figures 4-6. The reduction in both 85th percentile speeds and the percentage of drivers exceeding the speed limit was consistent through Week 5.

Lincoln Middle results indicate that drivers did travel slightly faster in between speed cushions.

Regardless of the spacing, the speed cushions successfully reduced the 85th percentile speeds by 8-10 MPH when compared to the Sunset Ave speeds or the 2006 baseline values.

Once the speed cushions were removed in Week 6 all speeds returned to the 2006 baseline values.

CONCLUSIONS

The initial 2006 study identified multiple problems in the Lincoln-Fearing-Sunset area.

This traffic calming experiment was aimed to reduce the speeds on Lincoln Ave without inconveniencing residents or users of the road. To this end the experiment was a success. All 85th percentile speeds on Lincoln Ave were reduced to values at or below the posted speed limits. Speeds between speed cushions were only slightly higher than the posted speed limits.

The traffic cushions did not, however, address the excessive traffic volumes nor did it address any of the problems identified on Fearing St.

RECOMMENDATIONS

The initial 2006 report recommended addressing the cut-through traffic volume problem first. If only local traffic uses the primarily residential street, drivers should (optimistically) respect the safety of their neighbors by travelling at or below the posted speed limits. There are two general approaches to reducing cut through traffic volumes. The first approach involves implementing on-street changes to reduce volumes while the second, off-street approach attempts to make other routes more appealing by removing the deterrents that are influencing drivers to cut-through smaller side streets.

On-Street Volume Reduction

The 2006 study also made some on-street recommendations that would have reduced cut-through volumes by creating a series of one way streets on the north end of Lincoln and Sunset Ave. The limited feedback received with respect to these two options was mostly negative. The negative feedback was primarily due to the overburdened inconvenience placed on the residents of the north end of Lincoln and Sunset Ave. These options should be revisited along with some other possible alternatives.

One possible on-street option that should be considered is called the half closure. The half closure or “pork chop” is a traffic calming measure that is slowly gaining popularity in the US. Figure 7 shows the typical design of a half closure.

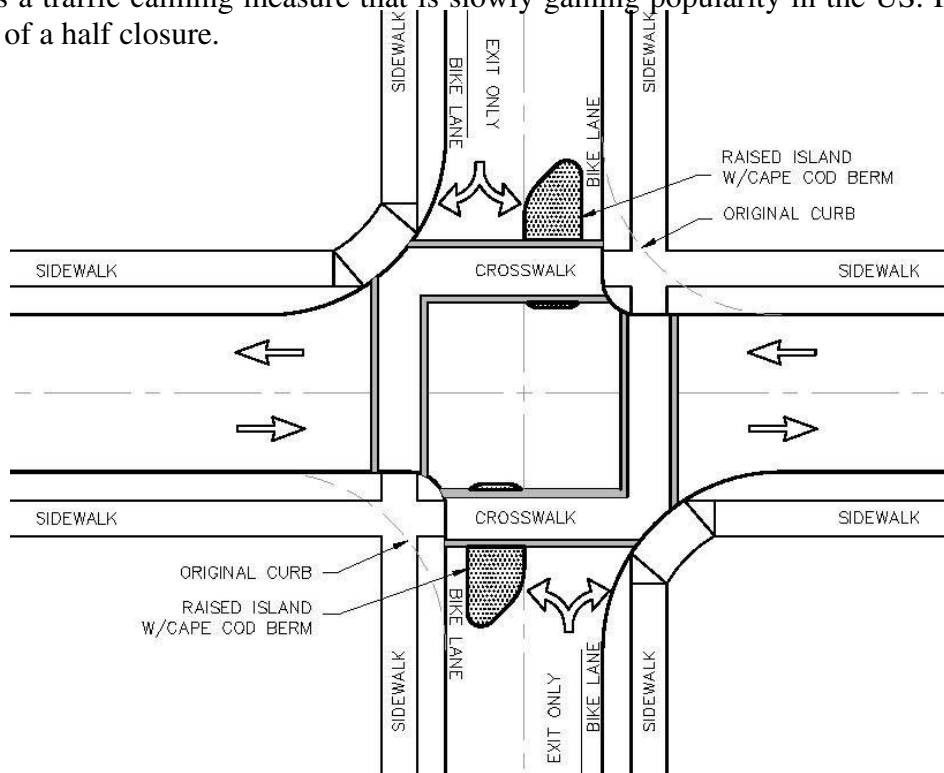


Figure 7: Typical Half Closure Design

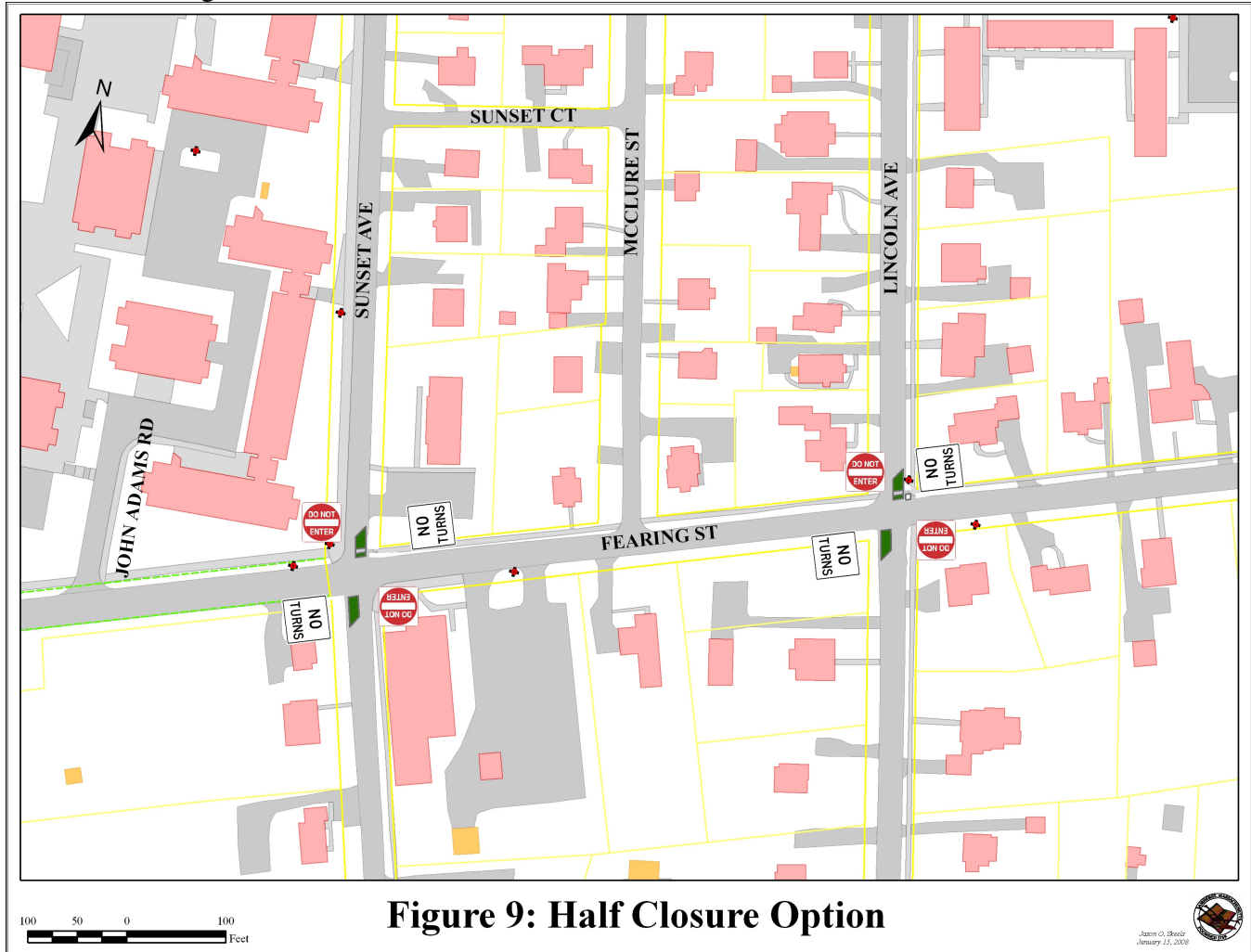
Full street closures are not an option on Lincoln, Sunset or Fearing due to their designation as emergency response routes. Half closures could be designed to allow emergency vehicles to pass with minimal delays to response times.

Figure 8 shows a picture of a permanent half closure in Sarasota, FL. Half closures can be designed to allow two way bicycle traffic. They are also less invasive (more accommodating to residents) than one way streets and they still allow emergency access by Public Safety vehicles. One argument against these measures involves the enforcement and possible disregard for the posted signs, however, during high volume traffic periods an approaching vehicle would block the path of any driver who might want to illegally “sneak” around the half closure island. Early enforcement efforts targeting offenders would also help to reduce this behavior.

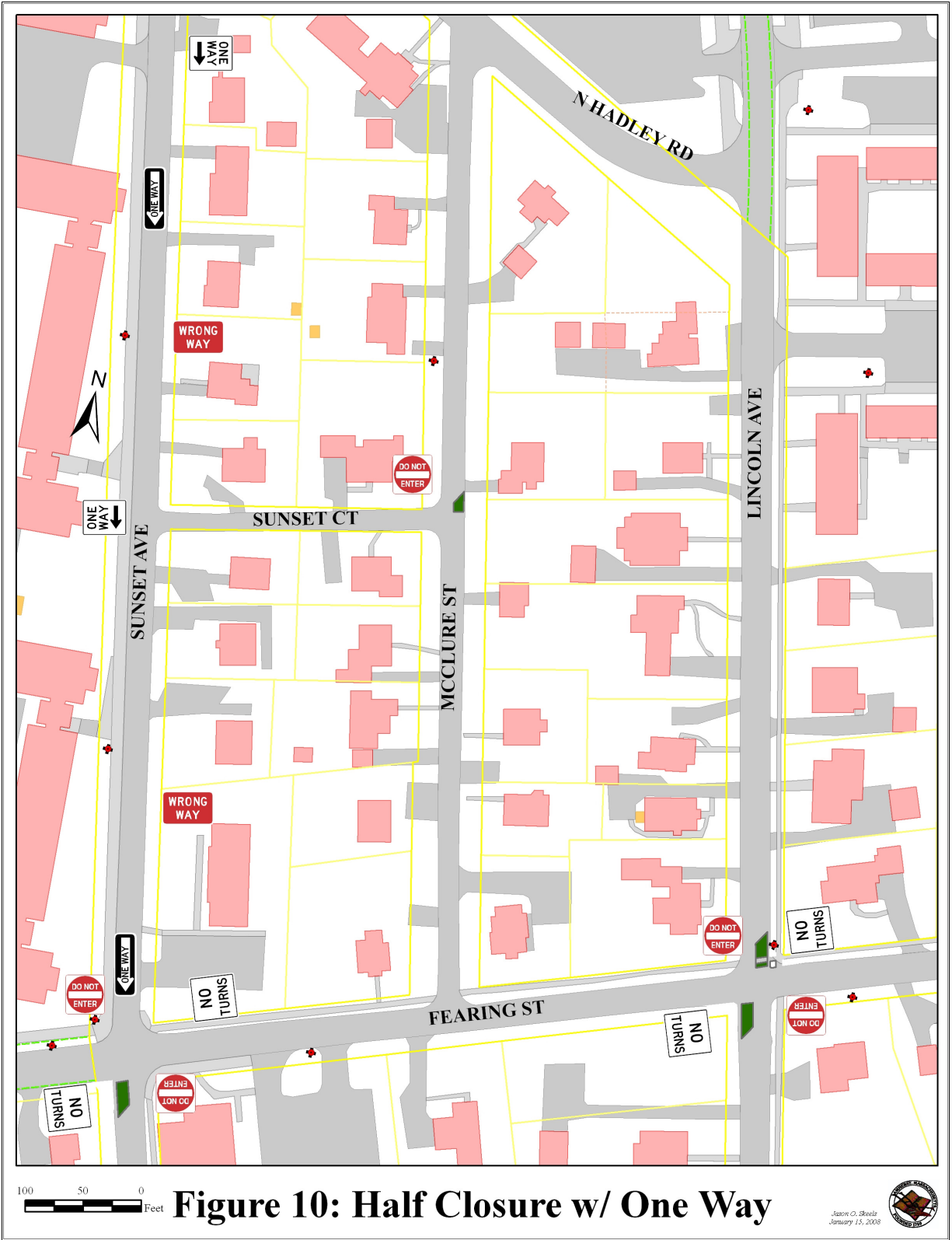


Figure 8: Permanent Half Closure

Figure 9 shows one possible arrangement that could be applied to Sunset and Lincoln Aves to effectively reduce cut-through traffic.



Half closures could be easily implemented and evaluated on a trial basis using simple Jersey barriers and additional signage. Prior to any trials, baseline traffic data will be needed on McClure St., Lincoln Ave (north of Fearing) and Sunset Ave (north of Fearing). Additional measures will most likely be needed on McClure St if the half closures are installed. If traffic volumes do increase on McClure; a combination of half or even full closures could be installed on both McClure and Sunset Ct. Figures 10 & 11 show two possible solutions for this anticipated problem. Installing a half closure on McClure and making Sunset Ave a one way street to the south would effectively eliminate cut through traffic as shown in Figure 10. As an alternative, full closures could be installed on both McClure and Sunset Ct. as shown in Figure 11.



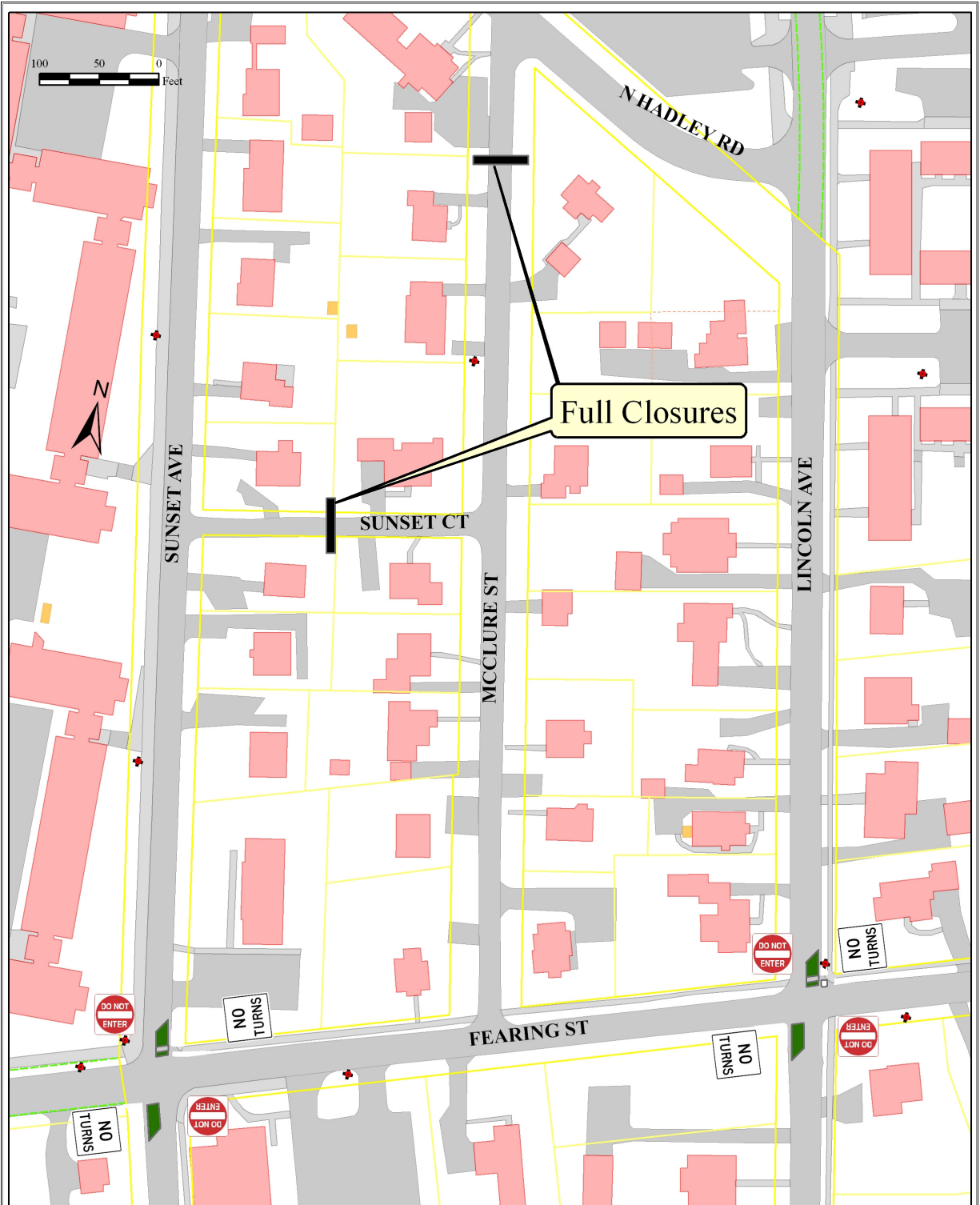


Figure 11: Half & Full Closures



Speed Reduction

Speed Cushions

It is clear that the speed cushions effectively reduced speeds on Lincoln Ave. If the speed cushion treatment is chosen as the desired traffic calming method the following recommendations should be considered:

- Cushions should be constructed using permanent bituminous concrete. This would allow them to remain in place throughout the year and would require less maintenance than the recycled rubber mats.
- More speed cushion sets should be added in order to shorten the 700 ft spacing between cushions and eliminate higher speeds achieved between speed cushions.
- Full width speed cushions should be considered and tested for approval by public safety officials in order to reduce the tendency for people to straddle the center cushion. If public safety does not approve of this modification then enforcement efforts should target drivers who cross the double yellow centerline to avoid the cushions.

The success of traffic calming measures depends on strong support by residents in the immediate area. The traffic calming measure needs to address the specific issue that the majority of residents perceive as being the problem. Public perception of the problem is vital in the success of any traffic calming experiment. Lincoln Ave residents should be polled to see if they think the traffic cushions alleviated what they perceived as the problem. If the residents do not feel as though the experiment was a success, then the perceived problem will still exist and other measures should be considered and evaluated.

Mini Traffic Circles

Another option that should be considered for speed reduction is the mini traffic circle shown in Figure 12. Mini traffic circles at the 3 and 4 way intersections along Lincoln Ave could effectively reduce speeds. The right of way at the intersections of Fearing and Amity are large enough to accommodate a mini traffic circle without the need for additional property takings. The 3 way intersections of Elm St, McClellan St and Cosby Ave might require additional property taking to fit the circles allowing for the correct geometry.

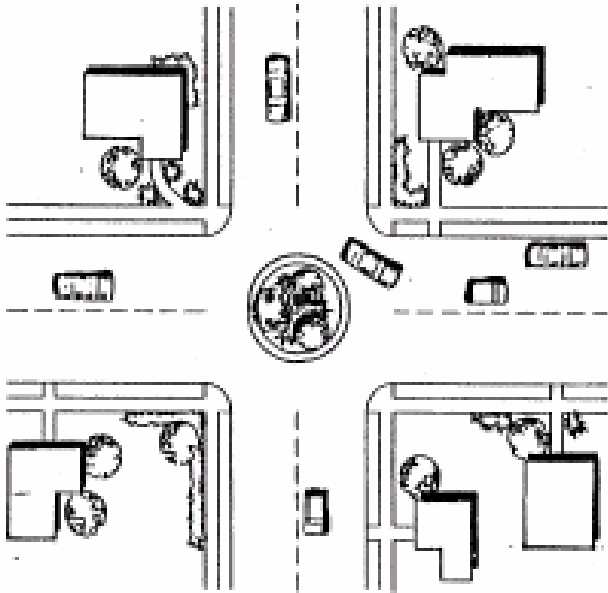


Figure 12: Mini Traffic Circle

Off-Street Volume Reduction

By creating more appealing, streamlined routes on our main corridors we can effectively redirect cut-through traffic to the desired locations. Poorly functioning intersections, traffic clogged roadways, unreasonable speed restrictions and enforcement and other unreasonable delays create the desire to seek alternate cut-through routes. Off-street volume reduction methods should focus on making Route 116, University Drive and Massachusetts Ave more appealing to drivers.

Public Works is currently redesigning the University Drive corridor from Northampton Road (State Route 9) to Amity Street.

The remainder of U Drive and Mass Ave are entirely owned by the University. In addition to streamlining traffic flows on the Town's portion of U Drive the University should study and address the intersections of U-Drive, Mass Ave and Governors Drive. Serious focus should also be placed on pedestrian traffic crossing over Mass Ave at the Sunset Ave intersection near the Southwest Residential area.

Discussions should also be started with the Town of Hadley and the Massachusetts Highway Department regarding revisions to the Route 116 and Route 9 interchange that would facilitate increased usage of route 116 as a main entrance to the UMass Campus.

APPENDIX

Table 1: Traffic Data Summary

Week	Location	Start Date	End Date	Lane Dir.	Total Volume	ADT	Speeds (MPH)			Exceeding Limit		Speeds	
							Average	Mode	85th %	Total #	%	Low	High
Baseline Data													
2006	Lincoln Ave (N)	04/13/06	04/18/06	SB	5,679	1,136	33	30	39	1,767	31%	10	>75
2006	Lincoln Ave (N)	04/13/06	04/18/06	NB	8,559	1,712	33	30	38	2,576	30%	10	>75
2006	Lincoln Ave (S)	10/13/06	10/20/06	SB	12,534	1,791	28	25	33	898	7%	10	>75
2006	Lincoln Ave (S)	10/13/06	10/20/06	NB	14,903	2,129	30	30	35	7,309	49%	10	>75
2006	Lincoln Ave (N)	11/14/06	11/21/06	SB	9,909	1,416	28	25	34	6,119	62%	10	>75
2006	Lincoln Ave (N)	11/14/06	11/21/06	NB	10,593	1,513	33	30	40	3,076	29%	10	>75
2006	Sunset Ave	04/28/06	05/03/06	SB	2,777	555	28	25	35	406	15%	10	>75
2006	Sunset Ave	04/28/06	05/03/06	NB	1,899	380	29	25	36	303	16%	10	>75
Speed Cushion Results													
1	Lincoln Ave (N)	09/07/07	9/12/07	SB	8,736	1,747	24.0	22	29	956	11%	3	50
1	Lincoln Ave (N)	09/07/07	9/12/07	NB	11,486	2,297	25.1	25	29	1,312	11%	5	58
1	Lincoln Ave (S)	09/07/07	9/12/07	SB	8,654	1,731	25.2	25	29	1,025	12%	3	48
1	Lincoln Ave (S)	09/07/07	09/12/07	NB	11,702	2,340	26.4	26	30	1,754	15%	3	56
1	Sunset Ave	09/07/07	9/16/07	SB	4,775	531	28.7	28	34	1,740	36%	10	49
1	Sunset Ave	09/07/07	09/16/07	NB	3,400	378	28.2	28	34	1,097	32%	7	57
2	Lincoln Ave (N)	09/20/07	9/26/07	SB	9,772	1,629	21.2	18	26	417	4%	2	55
2	Lincoln Ave (N)	09/20/07	9/26/07	NB	11,693	1,949	23.5	23	28	731	6%	6	66
2	Lincoln Ave (S)	09/20/07	9/26/07	SB	9,825	1,638	23.8	22	28	576	6%	4	54
2	Lincoln Ave (S)	09/20/07	09/26/07	NB	12,820	2,137	25.5	25	30	1,344	10%	8	53
2	Sunset Ave	09/20/07	9/26/07	SB	3,413	569	29.0	30	35	1,373	40%	7	57
2	Sunset Ave	09/20/07	09/26/07	NB	2,362	394	28.4	26	34	803	34%	8	63
3	Lincoln Ave (N)	09/28/07	10/4/07	SB	9,820	1,637	21.6	20	26	458	5%	2	50
3	Lincoln Ave (N)	09/28/07	10/4/07	NB	12,421	2,070	23.8	22	28	899	7%	8	57
3	Lincoln Ave (S)	09/28/07	10/4/07	SB	9,874	1,646	24.1	24	28	685	7%	9	46
3	Lincoln Ave (S)	09/28/07	10/04/07	NB	13,106	2,184	25.7	26	30	1,521	12%	3	46
3	Sunset Ave	09/28/07	10/4/07	SB	3,480	580	28.7	29	34	1,264	36%	6	55
3	Sunset Ave	09/28/07	10/04/07	NB	2,590	432	27.7	28	33	724	28%	9	54
4	Lincoln Ave (N)	10/05/07	10/11/07	SB	7,712	1,285	21.7	19	27	377	5%	2	51
4	Lincoln Ave (N)	10/05/07	10/11/07	NB	10,393	1,732	24.0	22	28	812	8%	6	57
4	Lincoln Ave (S)	10/05/07	10/11/07	SB	8,629	1,438	24.1	23	28	591	7%	8	45
4	Lincoln Ave (S)	10/05/07	10/11/07	NB	11,502	1,917	26.0	26	30	1,412	12%	7	50
4	Sunset Ave	10/05/07	10/11/07	SB	3,120	520	28.7	29	34	1,129	36%	9	58
4	Sunset Ave	10/05/07	10/11/07	NB	2,314	386	27.3	27	32	580	25%	10	59
5	Lincoln Ave (N)	11/01/07	11/4/07	SB	7,343	2,448	24.0	22	29	641	9%	6	57
5	Lincoln Ave (N)	11/01/07	11/4/07	NB	5,012	1,671	23.0	21	29	462	9%	6	57
5	Lincoln Ave (Mid)	11/01/07	11/02/07	SB	3,268	NA	28.0	28	32	879	27%	5	58
5	Lincoln Ave (Mid)	11/01/07	11/02/07	NB	4,743	NA	27.4	28	32	1,028	22%	8	56
5	Lincoln Ave (S)	10/25/07	11/4/07	SB	14,789	1,479	24.8	24	29	1,441	10%	2	56
5	Lincoln Ave (S)	10/25/07	11/04/07	NB	18,986	1,899	26.7	26	30	3,143	17%	3	49
5	Sunset Ave	10/25/07	11/1/07	SB	4,314	616	30.0	32	35	1,978	46%	8	55
5	Sunset Ave	10/25/07	11/01/07	NB	2,667	381	29.4	28	35	1,093	41%	6	62
Speed Cushions Removed													
6	Lincoln Ave (N)	11/08/07	11/14/07	SB	9,642	1,607	31.4	32	36	5,825	60%	7	61
6	Lincoln Ave (N)	11/08/07	11/14/07	NB	13,086	2,181	30.2	30	35	6,245	48%	6	67
6	Lincoln Ave (Mid)	11/08/07	11/09/07	SB	3,344	NA	30.9	32	35	1,804	54%	4	58
6	Lincoln Ave (Mid)	11/08/07	11/09/07	NB	4,408	NA	31.1	31	36	2,372	54%	9	60
6	Lincoln Ave (S)	11/08/07	11/11/07	SB	4,375	1,458	30.0	30	35	1,947	45%	7	52
6	Lincoln Ave (S)	11/08/07	11/11/07	NB	9,124	3,041	30.0	30	32	4,072	45%	4	52
6	Sunset Ave	11/08/07	11/14/07	SB	3,009	502	30.8	30	37	1,559	52%	12	57
6	Sunset Ave	11/08/07	11/14/07	NB	1,823	304	30.5	32	36	877	48%	7	60